Spitronics ECU - Engine Limits - Guide

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Overview

Engine Limits protects the engine against operating conditions that can cause damage, including excessive RPM, excessive Coolant Temperature and excessive Manifold Pressure.
Open:
Features → Engine Limits
This software version includes:
· Normal RPM Limit.
· Limiter Type.
· RapidFire Frequency.
· RPM Limit <60°C.
· High Temperature Limit.
· High Temperature RPM.
· Manifold Pressure Limit.
Engine Limits are protection settings. They should not be used as a substitute for correct engine tuning, Boost Control, cooling-system repair or suitable engine hardware.
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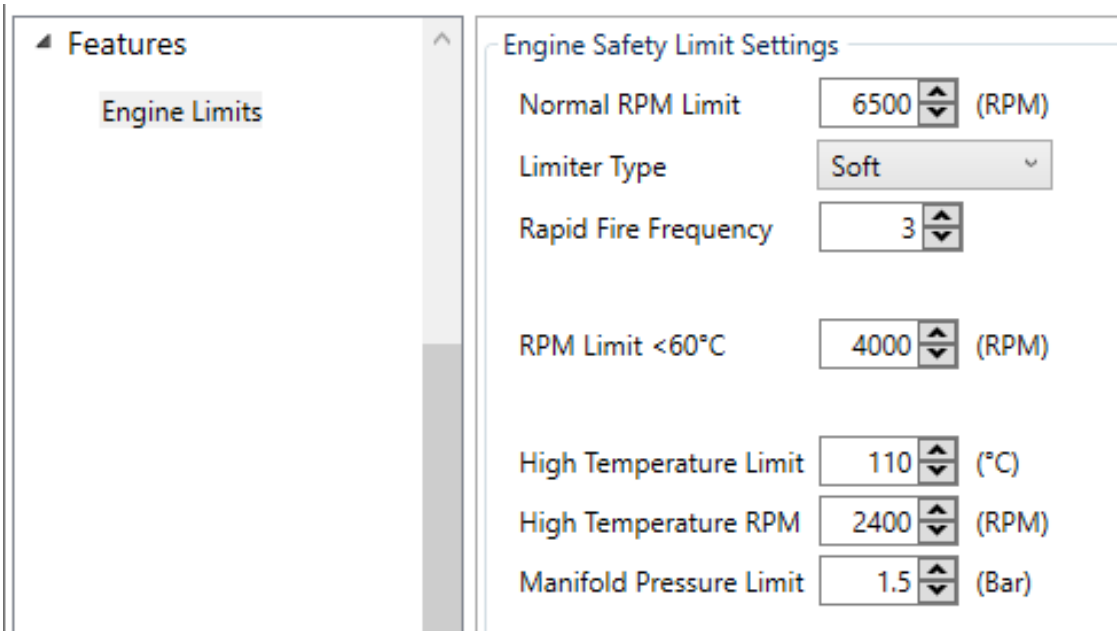
Engine Limits Software Page



The exact values must be selected for the engine, vehicle and intended use. The example screen above shows one possible configuration only.
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Normal RPM Limit

Normal RPM Limit sets the normal maximum engine speed.
Example:
6500 RPM
When engine speed reaches this limit, the ECU applies the selected Limiter Type.
DTC Code 9 is logged when the Normal RPM Limiter is reached.

Set the limit according to the safe operating speed of the engine. Allow suitable margin for valve-train capability, rotating assembly, turbocharger behaviour and the way the selected limiter controls RPM.
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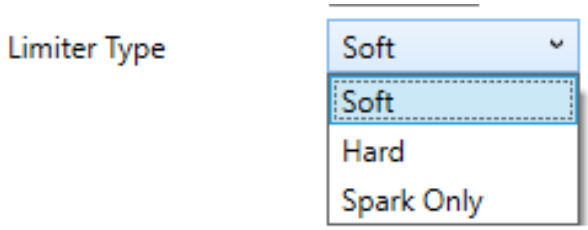
Limiter Type

Limiter Type determines how the ECU reduces engine torque when the Normal RPM Limit is reached.
Available selections are:
· Soft.
· Hard.
· Spark Only.



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Soft Limiter

Soft Limiter reduces engine torque progressively before applying a final Fuel Cut.
When RPM reaches the configured Normal RPM Limit, the ECU uses three stages:

RPM	Ignition Timing	Fuel
At Normal RPM Limit	15° BTDC	Normal
+100 RPM	7° BTDC	Normal
+200 RPM	0°	Fuel Cut

Example with Normal RPM Limit = 6500 RPM:
· 6500 RPM → timing is limited to approximately 15° BTDC.
· 6600 RPM → timing is limited to approximately 7° BTDC.
· 6700 RPM → timing is limited to 0° and Fuel Cut is applied.
This staged reduction produces a smoother loss of engine torque than an immediate hard cut.
Because the limiter works progressively, engine speed can rise above the configured Normal RPM Limit before the final Fuel Cut stage is reached. Set the Normal RPM Limit with enough safety margin for the engine.
Soft Limiter is normally the preferred method for normal engine over-rev protection where a smooth limiter action is required.
Soft Limiter is well suited to naturally aspirated engines where a smooth limiter feel is preferred. On a turbocharged engine, the retarded ignition stages can increase exhaust energy and may maintain or increase turbocharger boost. This can reduce the intended torque-reduction effect, so verify boost behaviour carefully before using Soft Limiter on a turbocharged application.
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Hard Limiter

Hard Limiter applies a direct fuel and spark cut when the Normal RPM Limit is reached.
Typical characteristics:
· Rapid and decisive RPM control.
· Strong torque interruption.
· More noticeable jerk through the drivetrain.
· Fuel and spark are interrupted together.
Hard Limiter is useful where a firm and predictable cut is required, but it is mechanically harsher than the progressive Soft Limiter.
With Split Sequential Injection, fuel and spark cuts do not necessarily occur at exactly the same point in the injection sequence. Some cycles may therefore contain only part of the normal fuel quantity.
Full Sequential Injection generally provides cleaner cylinder-specific cut behaviour. Because fuel and

spark cut timing are not necessarily identical, some unburned fuel may still enter the exhaust and ignite there.
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Spark Only Limiter

Spark Only interrupts ignition while fuel delivery continues.
This produces a more aggressive exhaust effect because unburned mixture can enter the exhaust and ignite there.
Possible effects include:
· Loud exhaust events.
· Increased exhaust temperature.
· Increased turbocharger energy on turbocharged engines.
· Catalytic converter damage where fitted.
· Additional thermal stress on the exhaust system.
Use Spark Only only where the application requires this behaviour and the engine and exhaust system are suitable.
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RapidFire Frequency

RapidFire Frequency controls the repetition pattern used by applicable RapidFire limiter operation. Changing the value changes the spacing and character of the limiter pulses.

RapidFire Frequency controls how often an ignition event is allowed during the limiter sequence, creating the characteristic machine-gun exhaust effect. Ignition events are alternated between the coils so that individual spark plugs are less likely to become excessively wet while the limiter is active.

The setting can be selected from 1 to 10 revolutions. A setting of 1 allows one spark event every revolution, while a setting of 5 allows one spark event every 5 revolutions.

Where the TuneBox push button is used, the selected starting value is loaded with the Tune. Each button press reduces the value by one step. When the sequence reaches 0, it returns to the configured starting value. This progressively increases the frequency of the exhaust events as the button is pressed.

This setting is still relevant even when the vehicle is not using the separate Launch / Spinning functions, because RapidFire is one of the limiter behaviours available to the ECU.
Where a RapidFire button or Tuning POT is fitted, the exact driver-control behaviour depends on the firmware and enabled Features.
A practical rule is to begin with a conservative frequency and test the effect briefly before making the limiter more aggressive.
RapidFire operation can increase exhaust noise, temperature and mechanical stress. Avoid prolonged limiter operation.
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RPM Limit <60°C

RPM Limit <60°C provides a lower RPM protection limit while the engine is cold.
Example:
4000 RPM
When Coolant Temperature is below approximately 60°C, this lower limit prevents the engine from being operated at the normal high-RPM limit before it has warmed sufficiently.
DTC Code 11 is logged when the Water / Coolant hot or cold temperature limiter is reached.
This cold-engine protection uses a Fuel Cut.
Select a value that protects the engine during warm-up without making normal cold operation impractical.
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High Temperature Limit

High Temperature Limit sets the Coolant Temperature above which over-temperature protection becomes active.
Example:
110°C
DTC Code 11 is logged when the Water / Coolant hot or cold temperature limiter is reached.
The value must suit the engine, cooling system and operating environment.
Do not use an excessively high value simply to prevent the warning or limiter from operating. An engine that is genuinely overheating must be investigated.
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High Temperature RPM

High Temperature RPM sets the maximum limp-mode engine speed while Coolant Temperature is above the High Temperature Limit.
Example:
2400 RPM
When the engine is above the configured High Temperature Limit, injection is cut above this RPM and restored as RPM falls below the limit.
This allows the ECU to restrict engine operation rather than immediately disabling the engine completely.
If overheating is caused by a burst hose, major coolant loss or another serious cooling-system failure, stop the engine as soon as it is safe to do so. The limp-mode RPM limit is protection, not permission to continue driving an overheating engine.
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Manifold Pressure Limit

Manifold Pressure Limit / older Boost Limiter protects a boosted engine against excessive manifold pressure.
Example:

1.5 Bar
When MAP exceeds the configured limit, the ECU cuts the injectors cleanly. Spark is not cut.
This function is a protection limit, not a Boost Controller.
When this limit is reached, DTC Code 10 - Max Boost Limiter Reached is logged. Fuel is cut and ignition timing is retarded to 0°. Normal fuel and ignition control are restored only when MAP falls below approximately 0.5 Bar or RPM falls below approximately 1500 RPM.

This recovery strategy prevents full engine power from being restored while the engine is still under high load. When the driver closes the throttle, manifold pressure normally falls quickly into vacuum, allowing recovery under a much lower-load condition.

Possible causes of an over-boost event include:
· Wastegate failure.
· Boost Control fault.
· Disconnected or damaged boost-control hose.
· Incorrect Boost Control setup.
· Mechanical turbo or wastegate problem.
Set the limit high enough to avoid nuisance cuts during normal boost control, but low enough to protect the engine if boost rises beyond the intended safe range.
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Engine Limiters and Boost Control

The Manifold Pressure Limit should always be treated as a final protection layer.
Normal boost must be controlled by the applicable Boost Control system or mechanical wastegate arrangement.
If the Manifold Pressure Limit activates, investigate why boost exceeded the intended level before increasing the limit.
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Engine Limiters and Coolant Temperature

Temperature-based engine protection depends on a correctly calibrated Coolant Temperature Sensor.
Before relying on RPM Limit <60°C or High Temperature protection, verify:
[ ] Coolant Temperature Sensor is wired correctly.
[ ] Sensor calibration is correct.
[ ] Realtime Coolant Temperature is believable from cold start through normal operating temperature.
[ ] The cooling system reaches and maintains its intended normal temperature.
A faulty temperature reading can cause unnecessary limiting or, more seriously, prevent the ECU from applying protection when the engine is genuinely overheating.
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Engine Limiters and MAP

Manifold Pressure protection depends on a correctly calibrated MAP Sensor.
Before relying on the Manifold Pressure Limit, verify:
[ ] MAP Sensor type is correct.
[ ] MAP calibration is correct.
[ ] Realtime MAP agrees with expected atmospheric and boost pressure.
[ ] The configured limit uses the same pressure convention shown by the software.

If the MAP Sensor reading exceeds its calibrated maximum scale or Realtime pressure range, the ECU cuts the injectors. Spark is not cut.
This is a separate protection for MAP Sensor range or calibration overflow.
When this condition is reached, DTC Code 38 - MAP Sensor Overflow is logged. Fuel is cut and ignition timing is retarded to 0°. Normal fuel and ignition control are restored only when MAP falls below approximately 0.5 Bar or RPM falls below approximately 1500 RPM.

As with the Manifold Pressure Limit, this recovery strategy avoids restoring full engine power while the engine is still under high load.

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Testing the Normal RPM Limiter

Initial limiter testing should be performed under controlled conditions.
1. Confirm the engine is fully warmed.
2. Set a conservative Normal RPM Limit below the engine's true maximum safe RPM.
3. Select the required Limiter Type.
4. Increase engine speed carefully until the limiter operates.
5. Confirm that RPM control matches the selected Limiter Type.
6. For Soft Limiter, confirm the torque reduction becomes progressively stronger as RPM rises through the stages.
7. Do not hold the engine on the limiter longer than required for the test.
8. Restore the required final RPM limit after testing.

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Testing the Cold RPM Limit

1. Allow the engine to cool below approximately 60°C.
2. Confirm the Realtime Coolant Temperature reading.
3. Set a conservative RPM Limit <60°C.
4. Increase RPM carefully until the cold limit operates.
5. Confirm that the limit is removed once the engine warms above the applicable temperature region.

Do not perform unnecessary high-RPM testing on a cold engine simply to prove the protection function.

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Testing High Temperature Protection

Do not deliberately overheat the engine to test High Temperature protection.
Where software or a suitable sensor-simulation method allows controlled testing, verify that the High Temperature limit and High Temperature RPM respond as expected without exposing the engine to damaging temperature.
During normal operation, if High Temperature protection activates, investigate the cooling system before continuing high-load use.
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Testing the Manifold Pressure Limit

Do not deliberately over-boost an engine simply to test the Manifold Pressure Limit.
Where practical, verify the protection at a conservative temporary setting under controlled load, then restore the correct final safety limit.
Always confirm that normal Boost Control is stable before testing close to the final protection value.
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Common Problems

Symptom	Possible Cause	Adjustment / Check
Engine hits limiter earlier than expected	Normal RPM Limit too low or cold limit active	Check RPM limits and Coolant Temperature
Soft Limiter feels like RPM continues rising	Progressive limiter stages operating	Allow safety margin; verify final cut stage
Hard Limiter feels very harsh	Normal Hard Cut behaviour	Use Soft Limiter if suitable
Spark Only creates excessive exhaust noise or heat	Unburned fuel entering exhaust	Reduce limiter use or select another type
Cold engine will not rev above a low RPM	RPM Limit <60°C active	Check Coolant Temperature and cold limit
Engine limited after overheating	High Temperature protection active	Stop and investigate cooling system
Boosted engine cuts suddenly under load	Manifold Pressure Limit reached	Check boost level and Boost Control
Manifold Pressure Limit activates repeatedly	Boost Control or wastegate problem	Find cause before increasing limit
RapidFire effect too aggressive	Frequency or limiter setup unsuitable	Use a more conservative setting

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Basic Setup Procedure

1. Confirm the engine Tune is suitable for operation.
2. Confirm the Coolant Temperature Sensor calibration.
3. Confirm the MAP Sensor calibration on boosted applications.
4. Set a safe Normal RPM Limit.
5. Select the required Limiter Type.
6. Set RapidFire Frequency where required.
7. Set RPM Limit <60°C.

8. Set the High Temperature Limit.
9. Set a safe High Temperature RPM.
10. Set the Manifold Pressure Limit on boosted applications.
11. Save the Tune.
12. Test each protection function only under controlled conditions.
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Safety

Engine Limiters can interrupt fuel and/or ignition very rapidly and can create high mechanical and thermal loads.
· Do not set an RPM limit above the safe capability of the engine.
· Do not rely on the limiter to protect an engine with unsuitable valve-train or rotating components.
· Avoid prolonged limiter operation.
· Use Spark Only and aggressive RapidFire behaviour cautiously because they can increase exhaust-system temperature.
· Do not deliberately overheat or over-boost an engine to test protection settings.
· Investigate repeated limiter activation instead of simply increasing the protection limit.
· Protect catalytic converters from unburned fuel and excessive exhaust temperature.
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Setup Check

[ ] Normal RPM Limit is safe.
[ ] Correct Limiter Type is selected.
[ ] Soft Limiter staged behaviour is understood.
[ ] RapidFire Frequency is suitable where used.
[ ] RPM Limit <60°C is suitable.
[ ] Coolant Temperature Sensor is calibrated correctly.
[ ] High Temperature Limit is suitable.
[ ] High Temperature RPM is suitable.
[ ] MAP Sensor is calibrated correctly on boosted applications.
[ ] Manifold Pressure Limit is suitable.
[ ] Boost Control is stable below the protection limit.
[ ] Limiter operation has been tested under controlled conditions.
[ ] Driver understands that protection limits do not replace fault repair or correct tuning.
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